# GRUBB PARSONS

## ASTRONOMICAL INSTRUMENTS

SIR HOWARD GRUBB PARSONS & CO. LTD., WALKERGATE, NEWCASTLE UPON TYNE 6
ENGLAND

# ASTRONOMICAL INSTRUMENTS

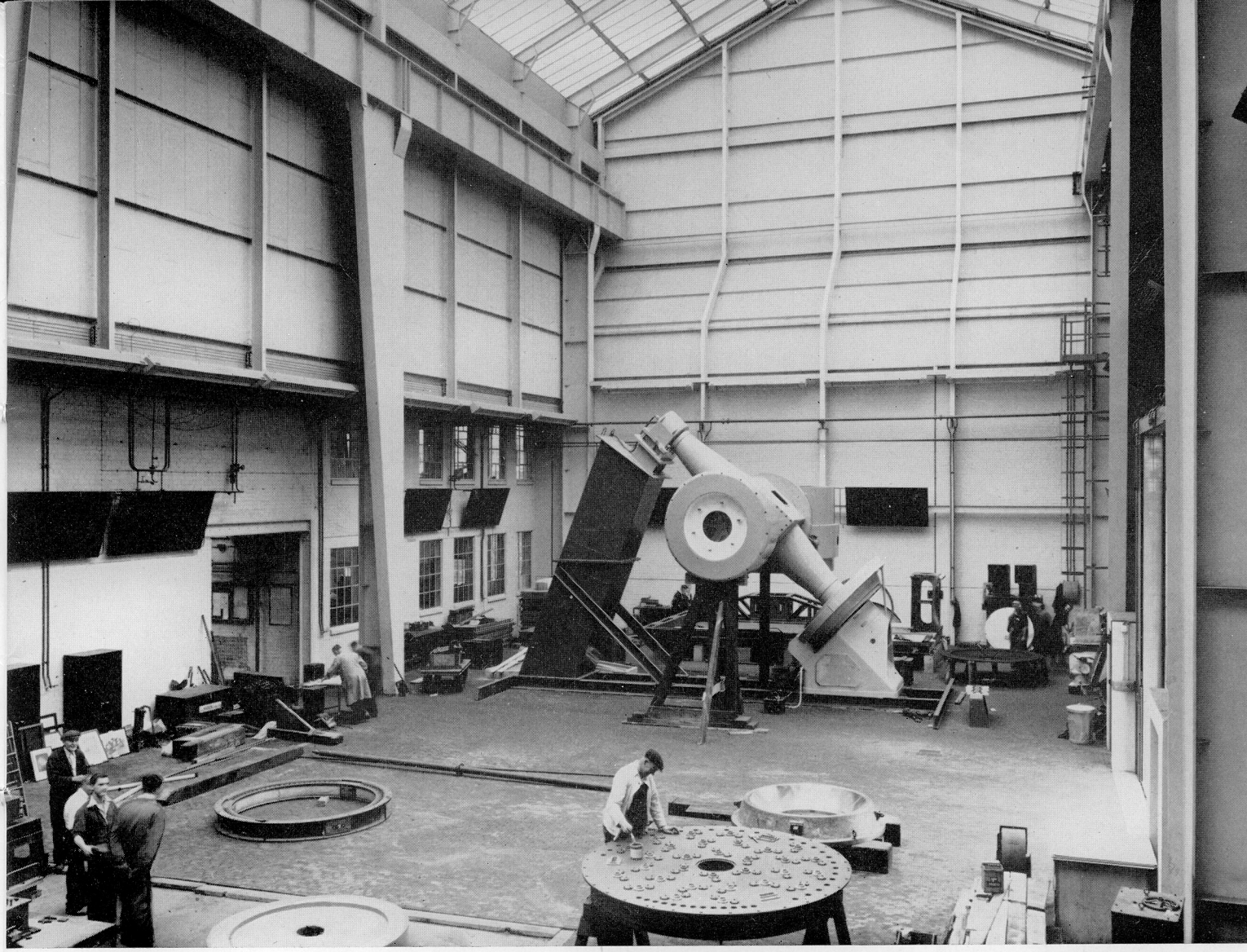
**SIR HOWARD GRUBB PARSONS & COMPANY LIMITED**
WALKERGATE · NEWCASTLE UPON TYNE 6
ENGLAND

# *Introduction*

Sir Howard Grubb Parsons & Co. Ltd. was founded in 1925 by The Hon. Sir Charles Parsons, O.M., K.C.B., F.R.S., in collaboration with Sir Howard Grubb, F.R.S., both of whom were personally interested in astronomy. The factory is situated on the outskirts of Newcastle upon Tyne and the shops are equipped for the manufacture and assembly of the largest telescopes together with the production of the extremely accurate mirrors. The grinding, polishing and aluminising of the mirrors is undertaken in specially equipped workrooms.

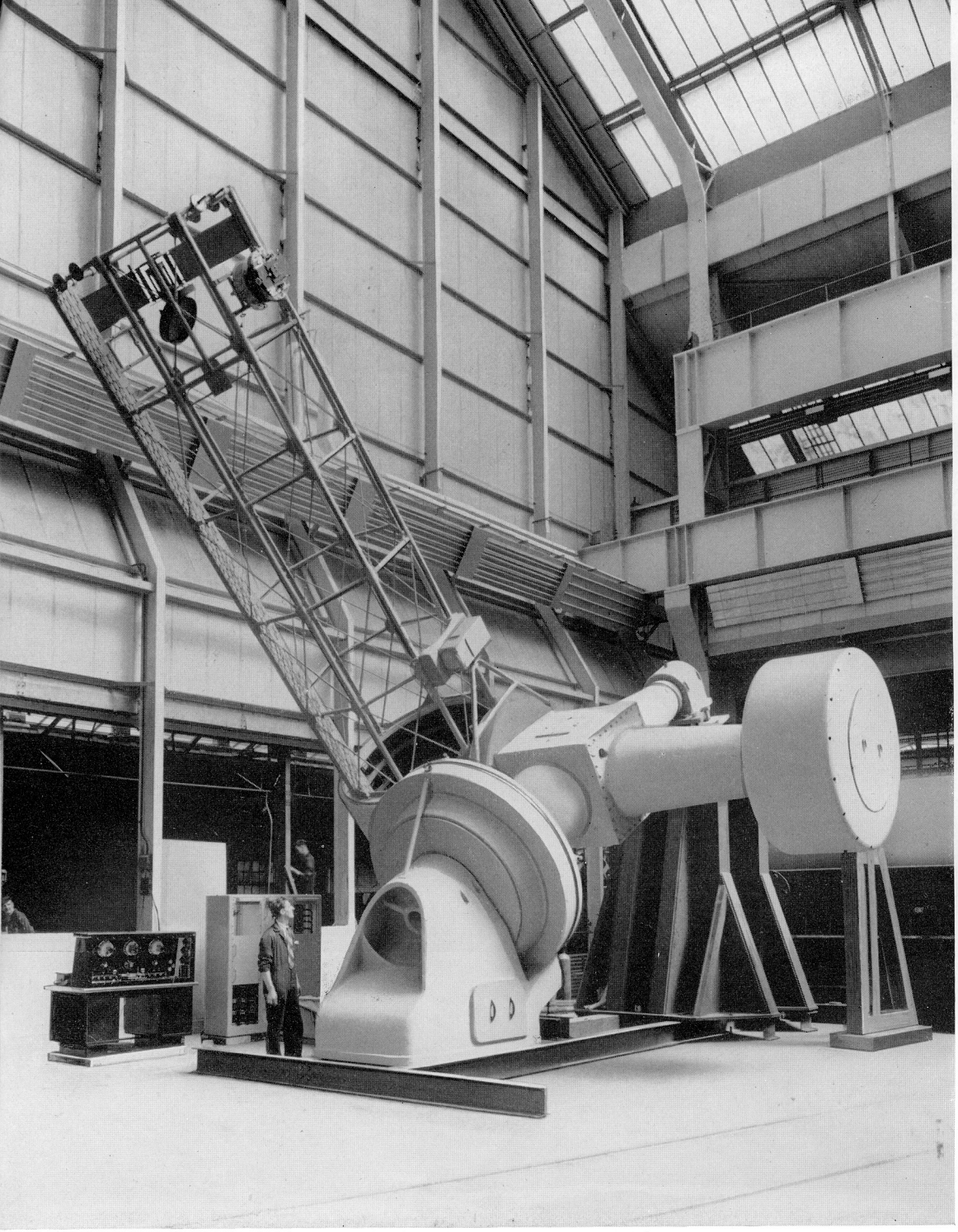
In addition to the manufacture of astronomical instruments the Company produces many scientific instruments including—infra red gas analysers, spectrometers and other electronic apparatus.

A selection of astronomical instruments and equipment designed and built by Grubb Parsons is illustrated on the following pages.



## ASSEMBLING A LARGE REFLECTOR

This photograph was taken inside the large erecting bay. The 75-inch Reflector for the St. Michel Observatory, France, is seen in the shop partly assembled. In the foreground is a part of the mirror cell, with the multiple lever support system for the mirror itself.



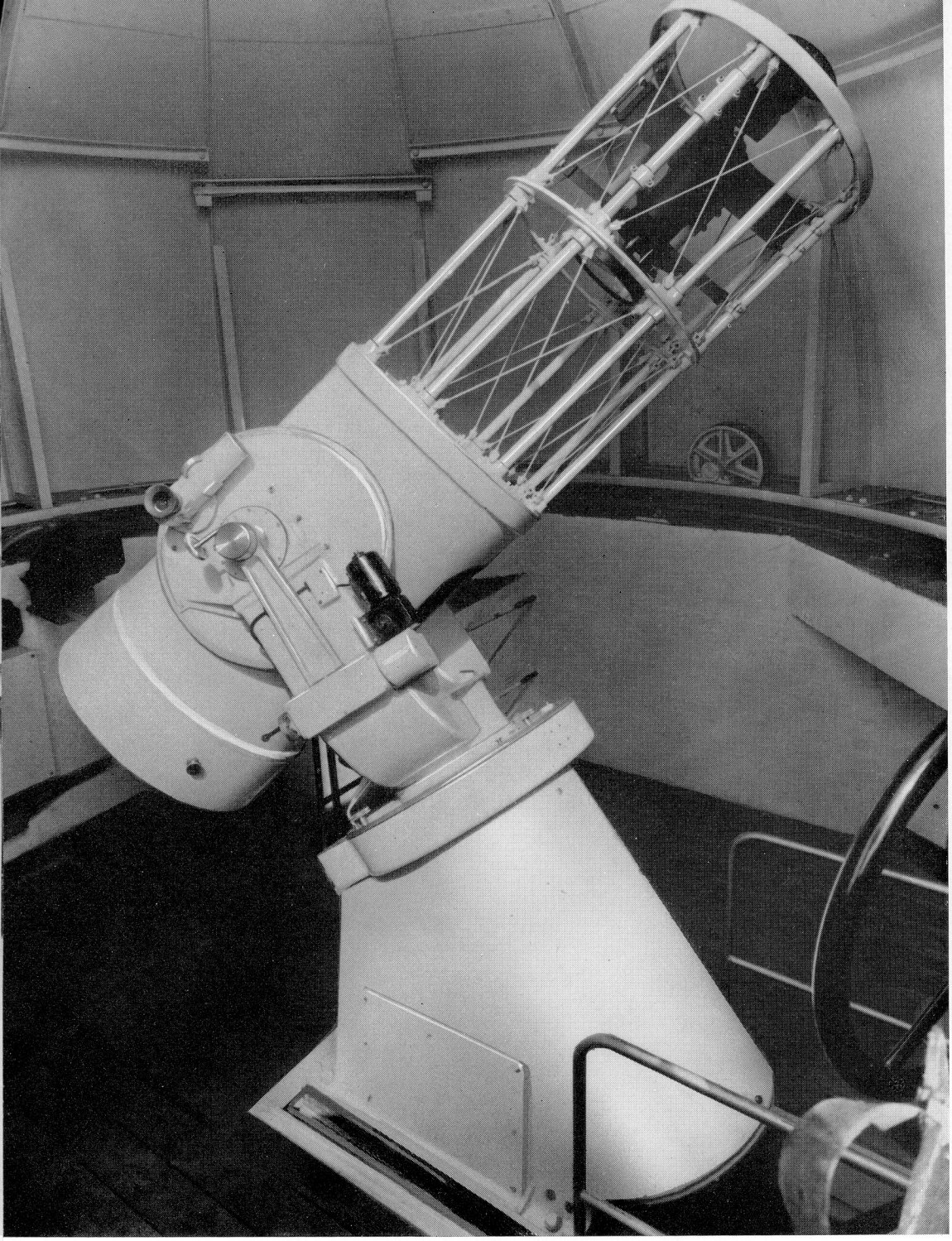
## 74 INCH REFLECTING TELESCOPE

This telescope built for the Cairo University is shown erected in the Works for mechanical and electrical tests. It is a conventional parabolic reflector on an English mounting and is equipped for use at the Newtonian, Cassegrain or Coudé Focus. Both Cassegrain and Coudé spectrographs are supplied with the instrument. The photograph shows the excellent facilities available within the Works for the erection of such large instruments.



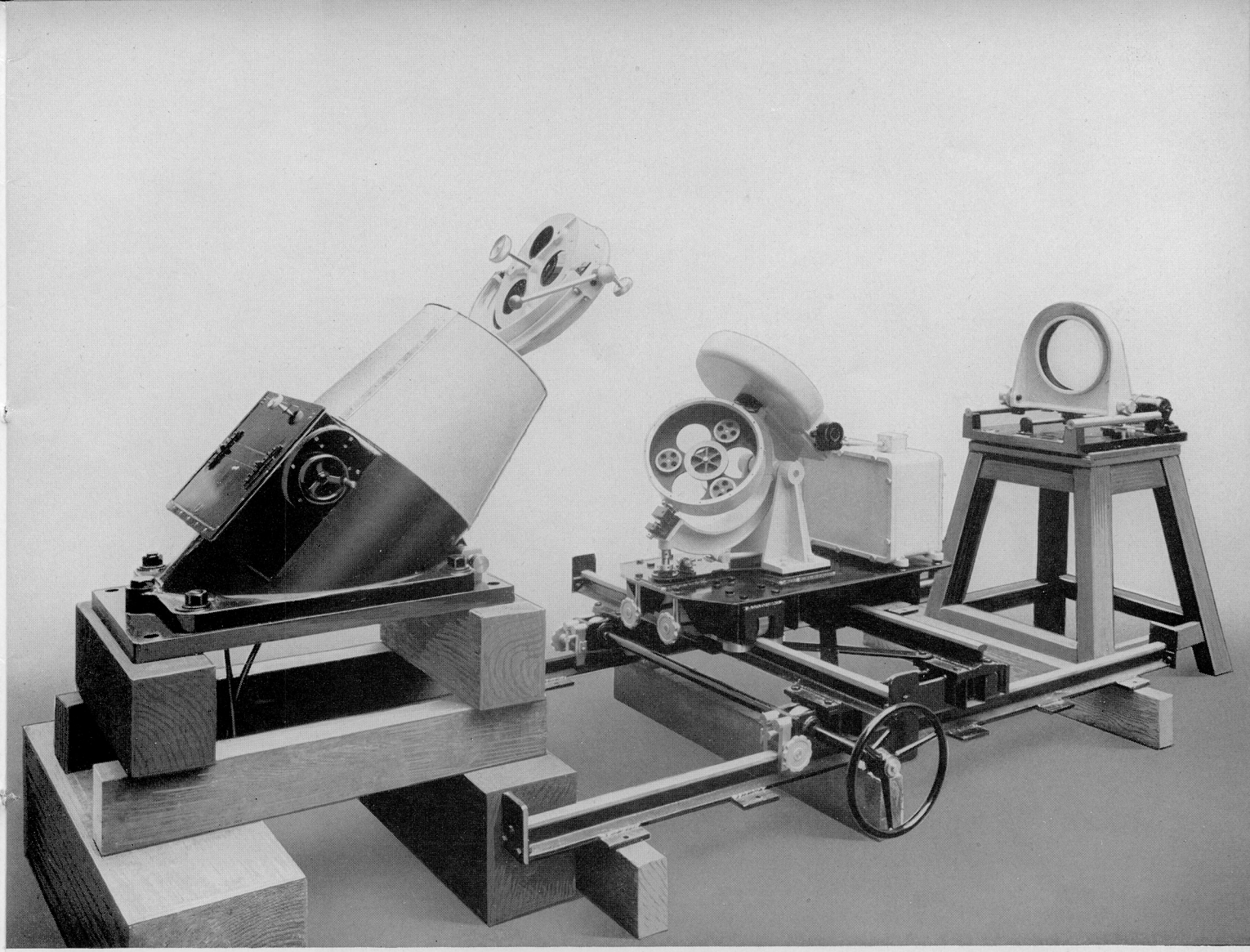
## CONTROL DESK

All telescope controls grouped together at a desk offer the maximum convenience to the observer. The photograph shows a 74-inch telescope control desk which is typical of present day practice. Not only are readings of Declination and Right Ascension indicated on the large dials, but a loud speaking communication system is provided connecting the desk to the various observing stations.



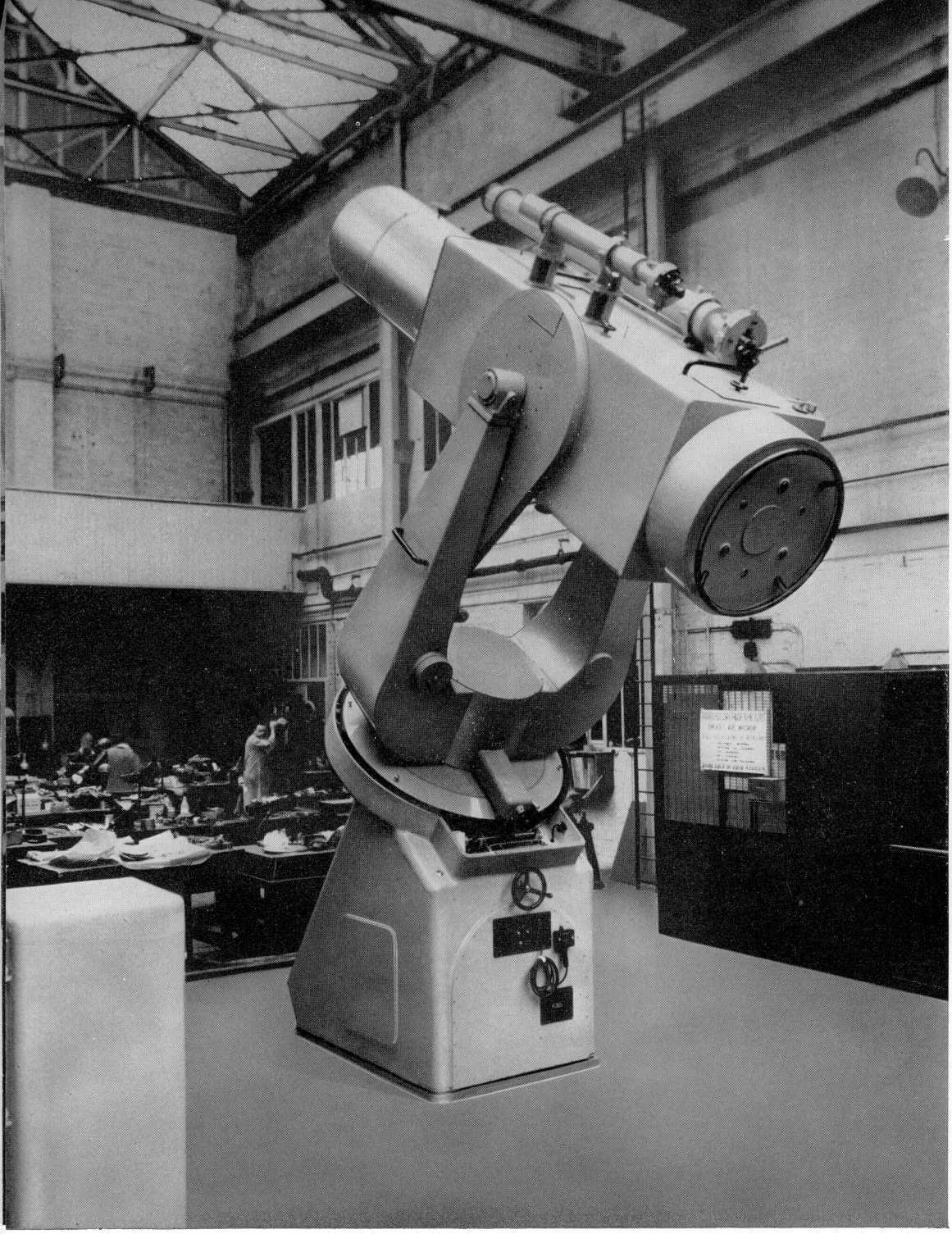
**20 INCH SOLAR TELESCOPE**

The photograph shows an unusual type of instrument designed to meet the special requirements of the Oxford University Observatory. The primary mirror is a 20-inch aperture parabola of fused quartz, with focal ratio of *f*5, carried in a fork type mounting at the top of a tower. The Cassegrain secondary also of fused quartz gives an effective focal length of 117 ft. and the beam is fed down through the hollow polar axis by a half speed flat mirror, into a horizontal spectrograph chamber below ground level.



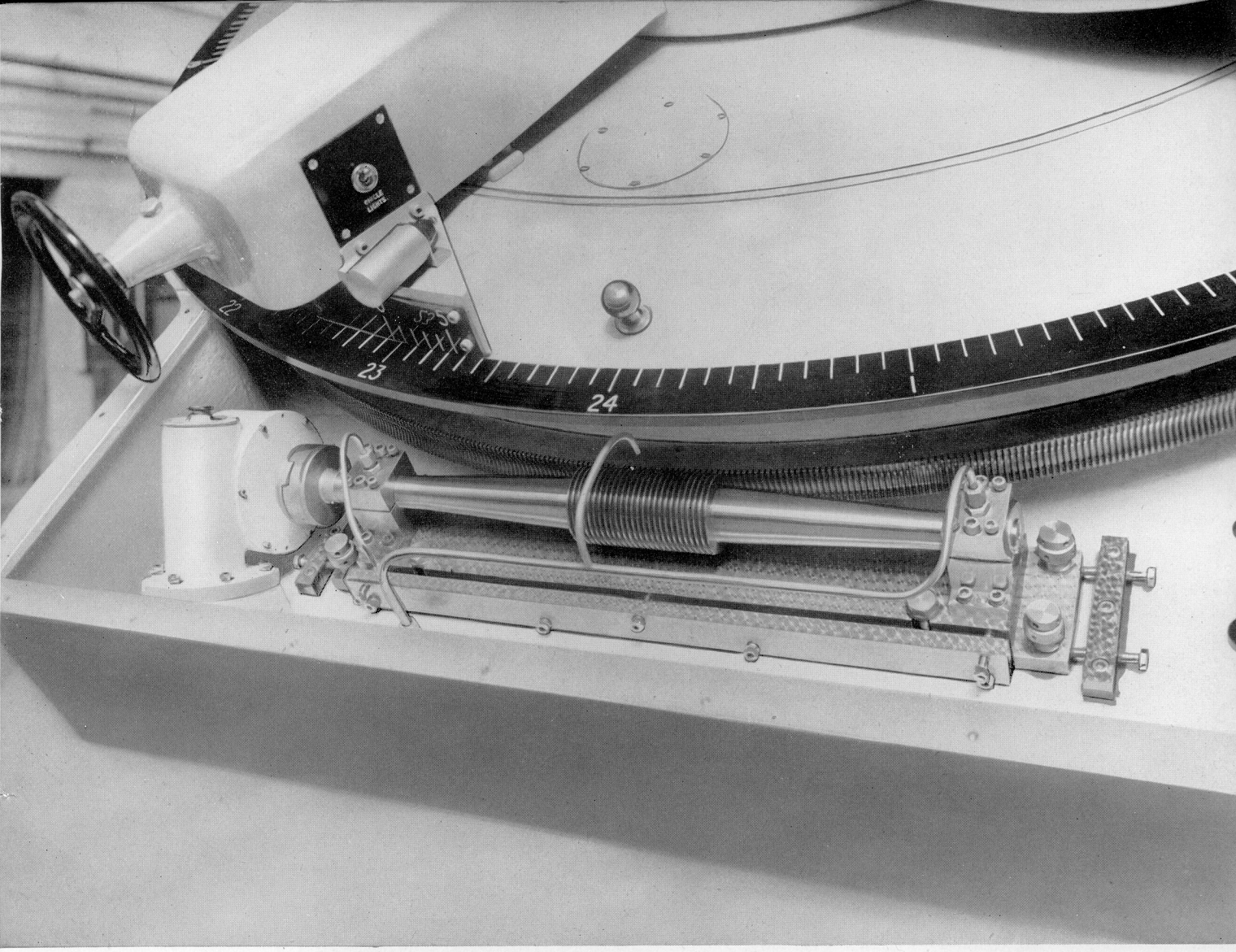
## 10 INCH HORIZONTAL COELOSTAT

This is a conventional horizontal coelostat, and the various parts are shown set up in the workshop. The two fused quartz flat mirrors are each 12 inches diameter, and all the mechanism controlling their motions is totally enclosed. The instrument is erected at the Arosa Observatory in the Swiss Alps, a favourable situation for solar work with such an instrument. At normal altitudes a tower type of instrument is generally to be preferred.



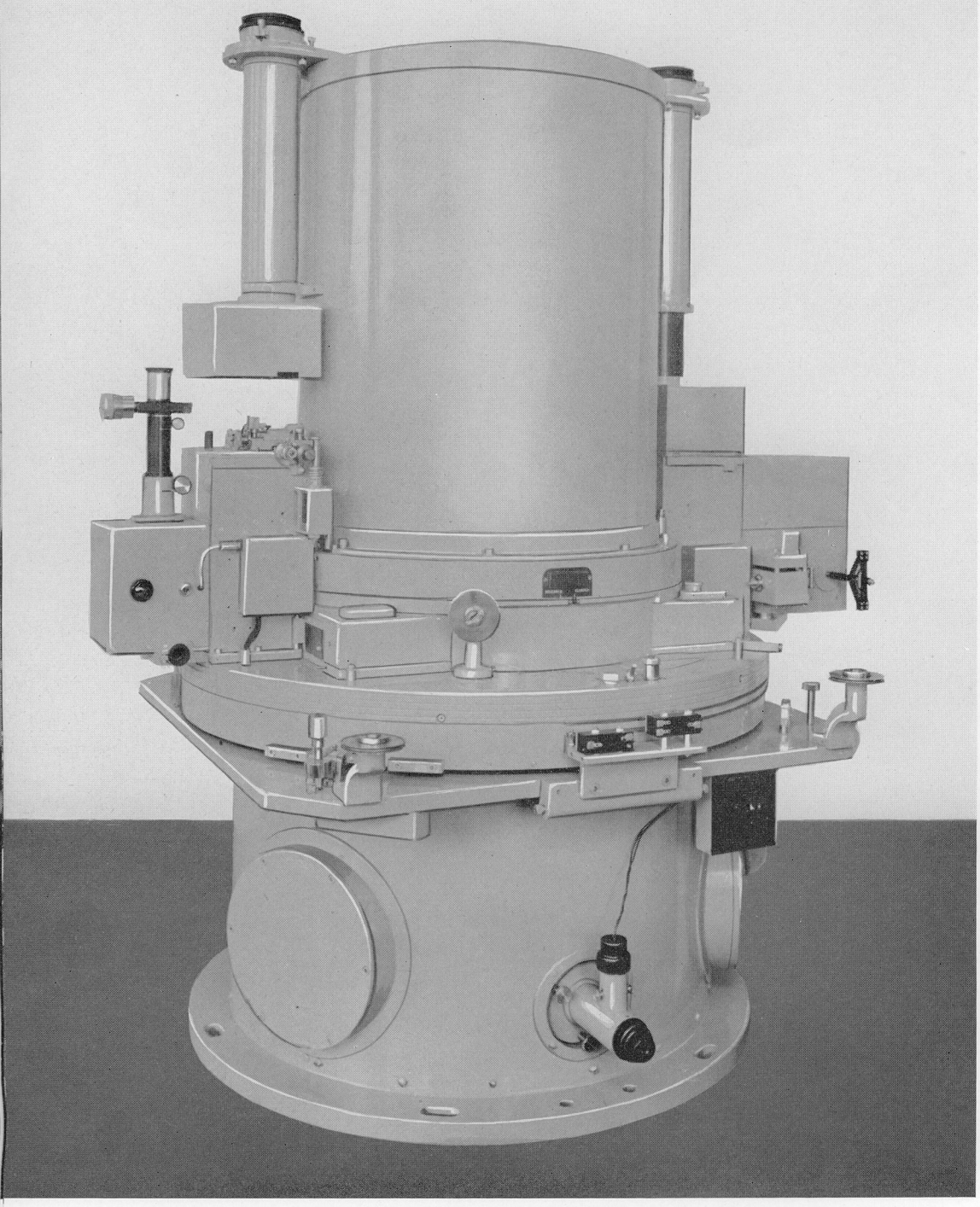
**17-24 INCH SCHMIDT CAMERA**

This camera is installed at the Cambridge University Observatory. The telescope has a focal length of 64 inches and takes plates 6 inches diameter; it is carried upon a fork type mounting of very rigid design. The plate-holder swings to the edge of the tube for easy plate changing and the focal distance is thermally matched to the mirror to annul changes of focus due to temperature variations. The instrument is primarily intended for in-focus photometry necessitating plate location to within a thousandth of an inch of the optical focal surface.



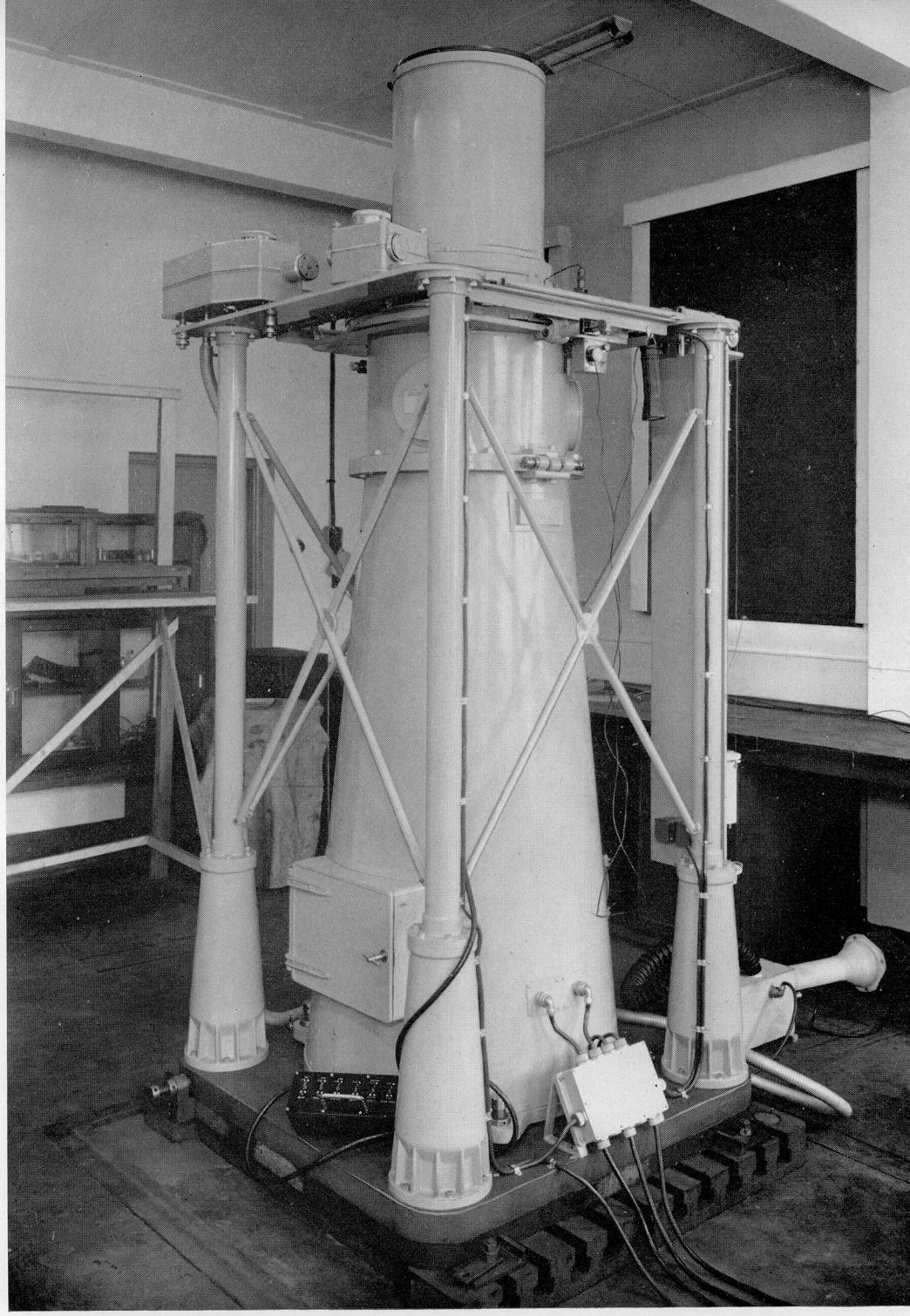

## SIDEREAL DRIVE

The accurate worm and wheel drive to the Polar Axis of the Cambridge 17-24 inch Schmidt Telescope. According to usual practice the worm is mounted upon a very rigid yet fully adjustable support so that correct meshing can be obtained. An oil feed is continually delivered to the bearings and to the worm and wheel engagement. The performance of these drives is usually smooth and accurate to about half a second of arc.



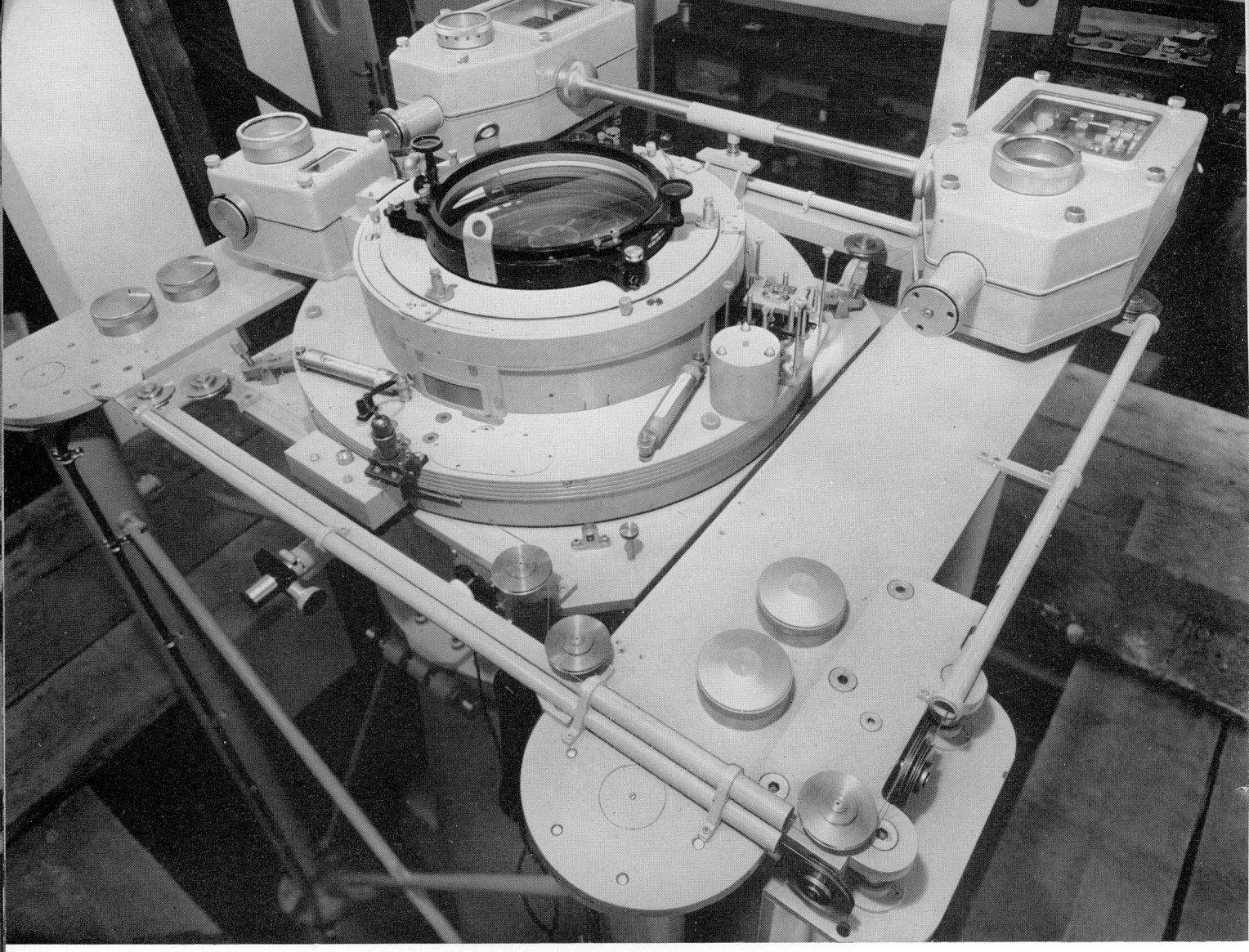
**THE 10 INCH GREENWICH PHOTO ZENITH TUBE, TYPE 1**

The photograph shows the upper half of the P.Z.T. designed to meet the special requirements of the Royal Greenwich Observatory, and installed at Herstmonceux. On either side of the dewcap can be seen the photographic chronographs registering plateholder position at known observatory time intervals. The instrument is intended for accurate time determination as well as the study of latitude variation.



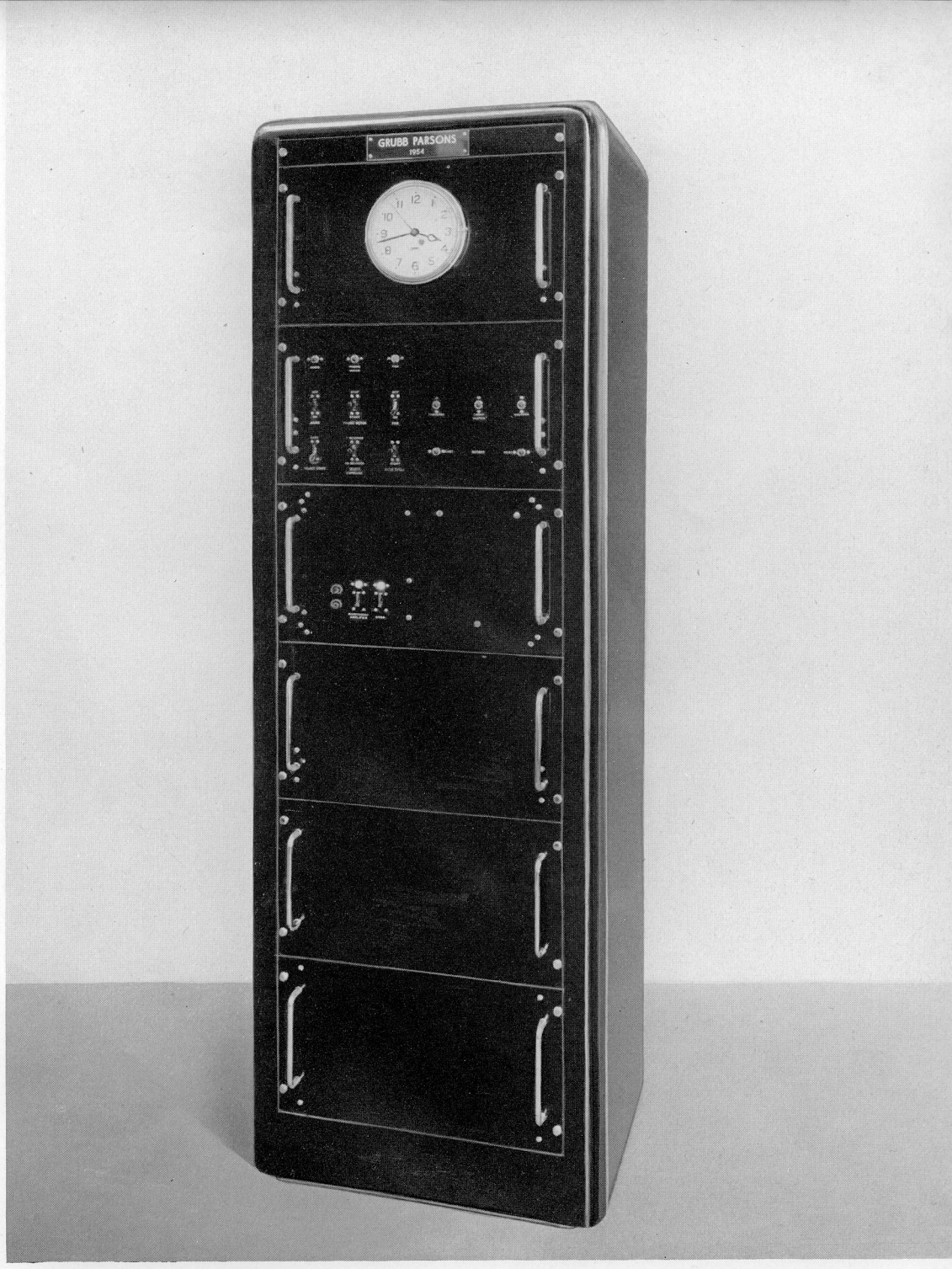
## 10 INCH PHOTO ZENITH TUBE, TYPE 1A

This telescope is the same in principle as the Greenwich P.Z.T. but the design has been simplified in many ways by some sacrifice in convenience with little loss of precision. The telescope was built for the Neuchatel Observatory where it has been in satisfactory service since 1954. The access door to the mercury trough is seen at the foot of the conical tube; the photograph was taken in the mechanical test laboratory at the Works.



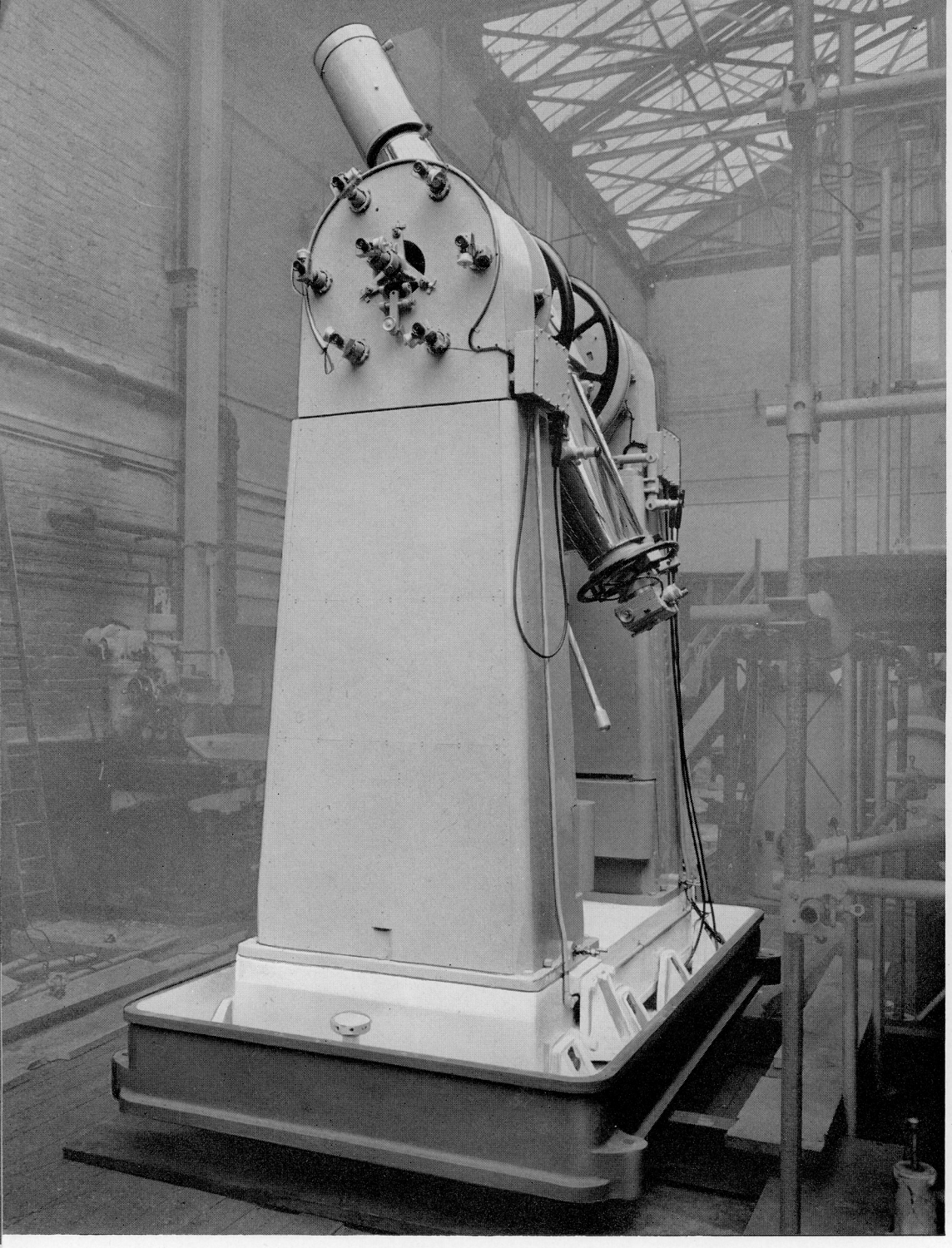
## CONSTRUCTIONAL DETAILS

A view looking down on the Mt. Stromlo 10 inch P.Z.T. showing the Object lens mounted upon the Rotary. The instrument is shown assembled in the laboratory for performance tests. The Rotary is turned by a system of wires which exert a pure turning torque; these wires and their pulleys can be well seen. The objective is of the flint first type with second Gaussian plane 12 mms. below the rear face of the crown lens, the photographic plate is located in this plane and can just be seen through the lens.



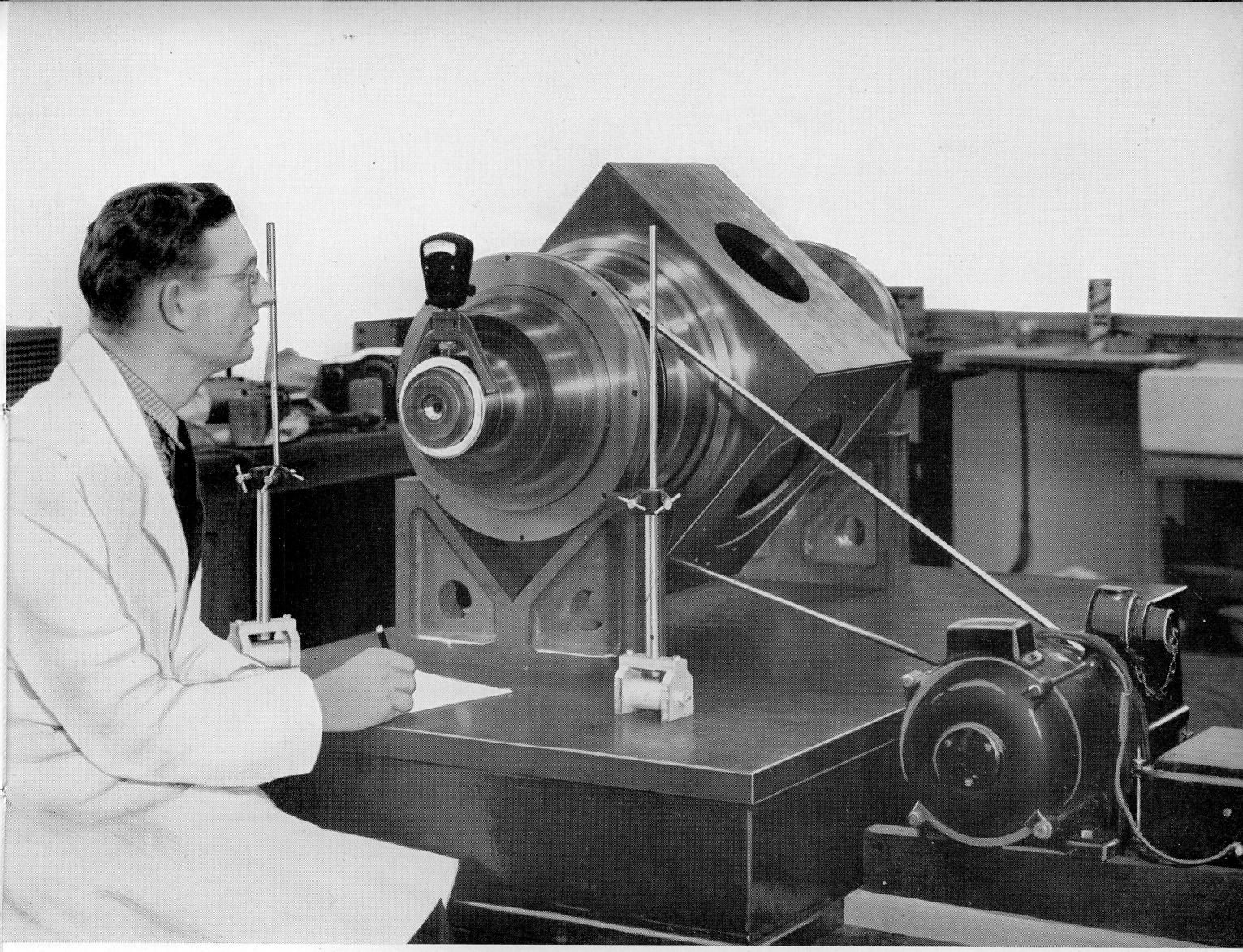

## CONTROL RACK

The controls for the Mt. Stromlo P.Z.T. are assembled in a rack in a building remote from the telescope pavilion. Here all the operations of the telescope can be watched and controlled by the observer under the most favourable conditions. After the telescope has been correctly prepared, a night's observations can be recorded on the photographic plates by the manipulation of a few simple switches.



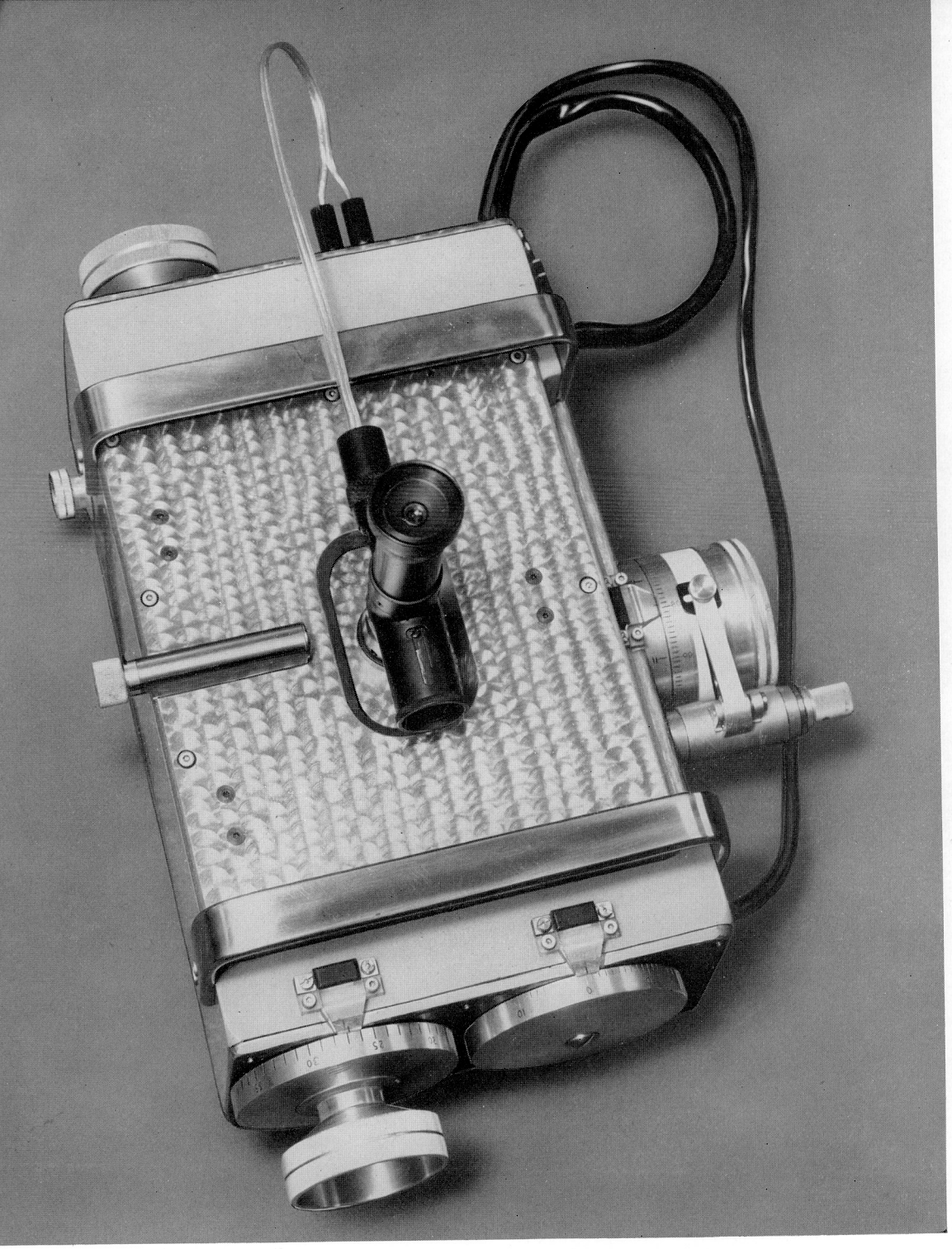
## 7 INCH MERIDIAN CIRCLE

This telescope, built for the San Fernando Observatory is equipped with six micrometer eyepiece microscopes viewing a glass circle with 5′ divisions. Pivot error determination is by inspection of a dot graticule on the axis through a central measuring microscope which can also be seen in the photograph. The two piers are carried upon a common bedplate which is adjustable in azimuth and level; they are both filled with water and heavily insulated.



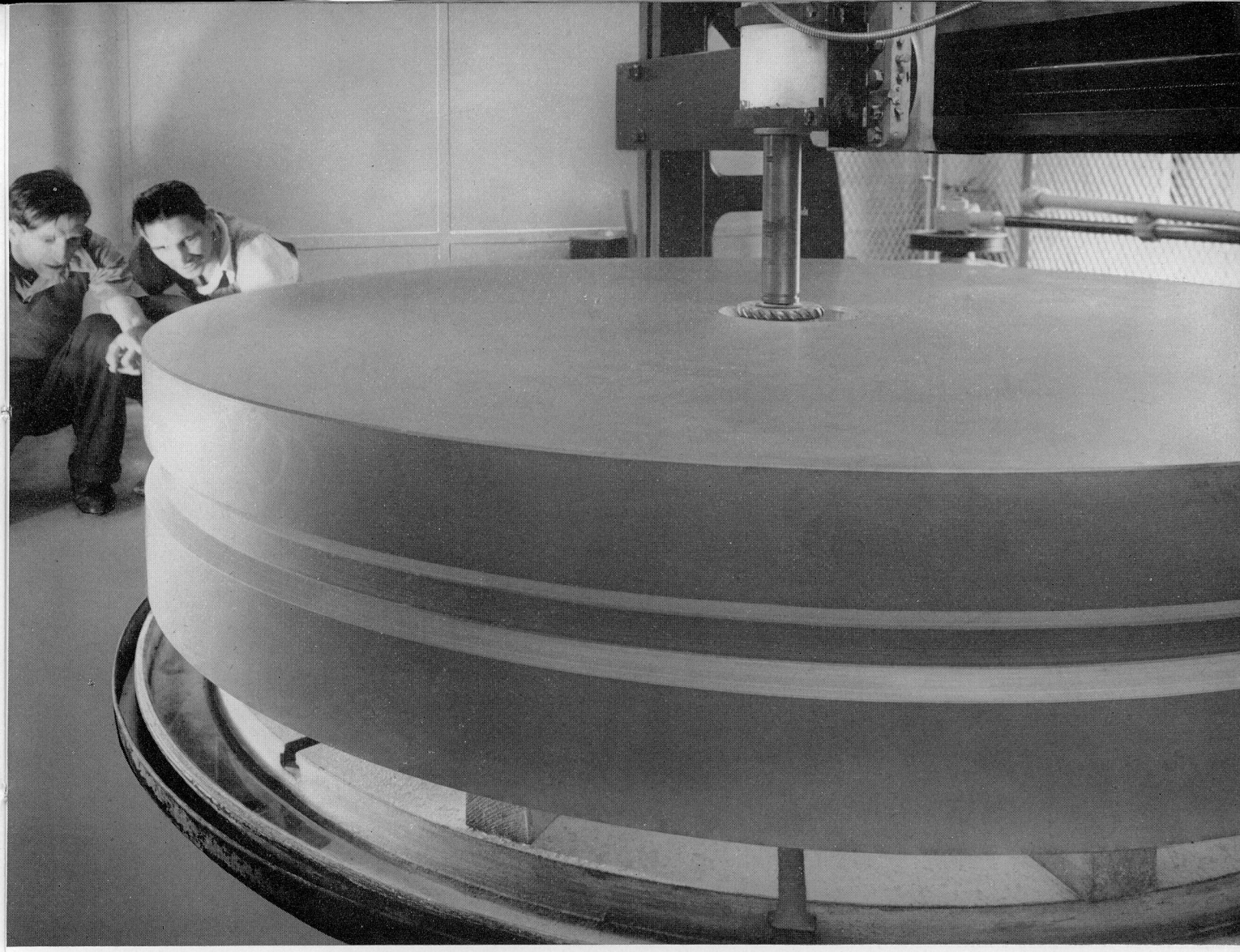
**PIVOT TESTING**

A Meridian Circle axis is shown set-up in the mechanical test laboratory during manufacture. The chromium plated pivots 5 inches diameter were successfully lapped cylindrical and equal to within half a micron. The photograph shows readings being taken on one of the pivots to determine its figure of shape.



## IMPERSONAL MICROMETER

Fitted to the San Fernando Meridian Circle this micrometer has a miniature driving motor controlled by four decade dials affording a wide range of reliable speed control. Declination readings are made on paper by pricker and the R.A. screw is fitted with accurate contacts for electrical registration of the transit time.



**THE GLASS SHOPS**

The edge and faces of this 98-inch diameter low expansion glass disc have been diamond milled to the required dimensions and the central hole is about to be trued up. The weight of this solid disc is about 9,000 lb. and in the process of truing it up and hollowing out the concave face nearly 1,800 lb. of glass had to be removed.



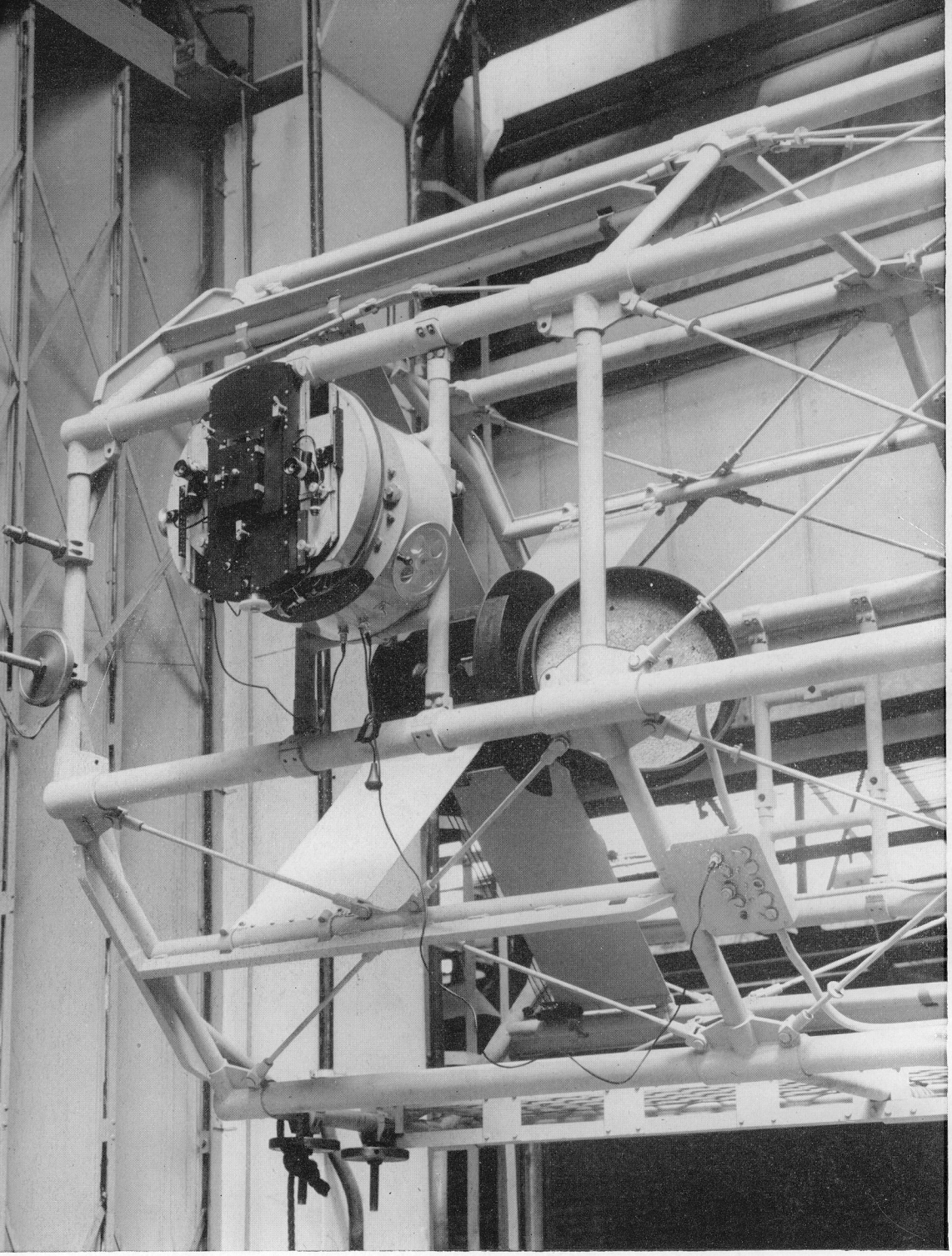
## FIGURING

The photograph shows a finished spherical mirror 98 inches in diameter accurate to about a tenth of a wavelength of visible light. The room in which the large mirrors are polished is equipped with a dark tunnel and full testing apparatus most of which has been specially designed and made in our own Works. Temperature in the room is held constant by a carefully arranged system of wall heating. A tower 100 ft. high is in course of construction for the vertical testing of mirrors up to 120 inches aperture lying in their cells under working conditions.



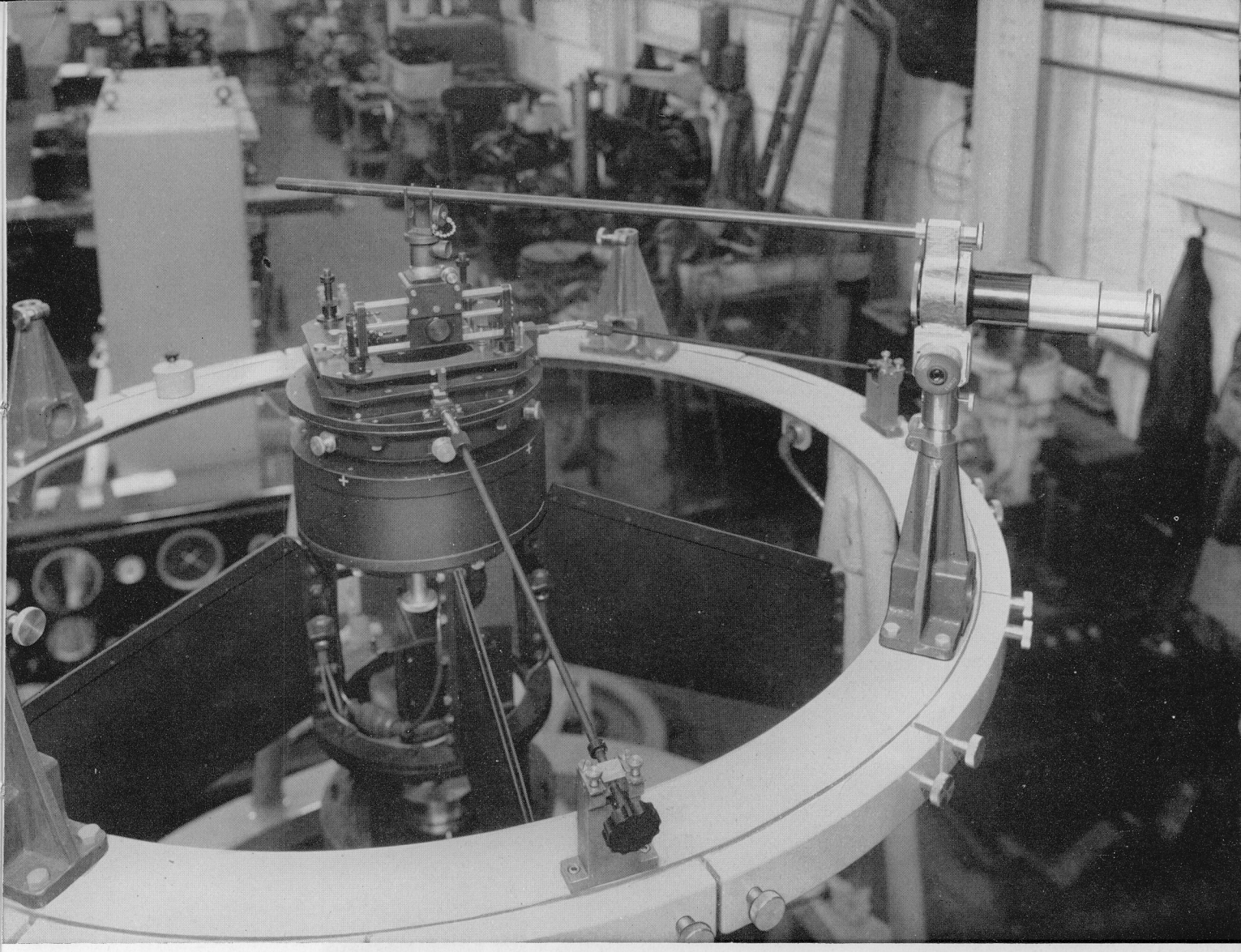
## ALUMINISING

A 74-inch mirror after coating in a large aluminising plant built for the Mt. Stromlo Observatory. In addition to the design and supply of large aluminising tanks for telescope mirrors, the workshops are equipped with coating plant for processing discs up to a metre in diameter, as well as the routine aluminising of small mirrors.



## NEWTONIAN FOCUS

The double slide plateholder and focussing gear on the 74-inch Reflector for Cairo University, Egypt. This plateholder has totally enclosed slide and screw mechanism, with positive action and freedom from backlash. Plates of various sizes up to 160 mm. square can be accommodated, and two guiding microscopes are provided.



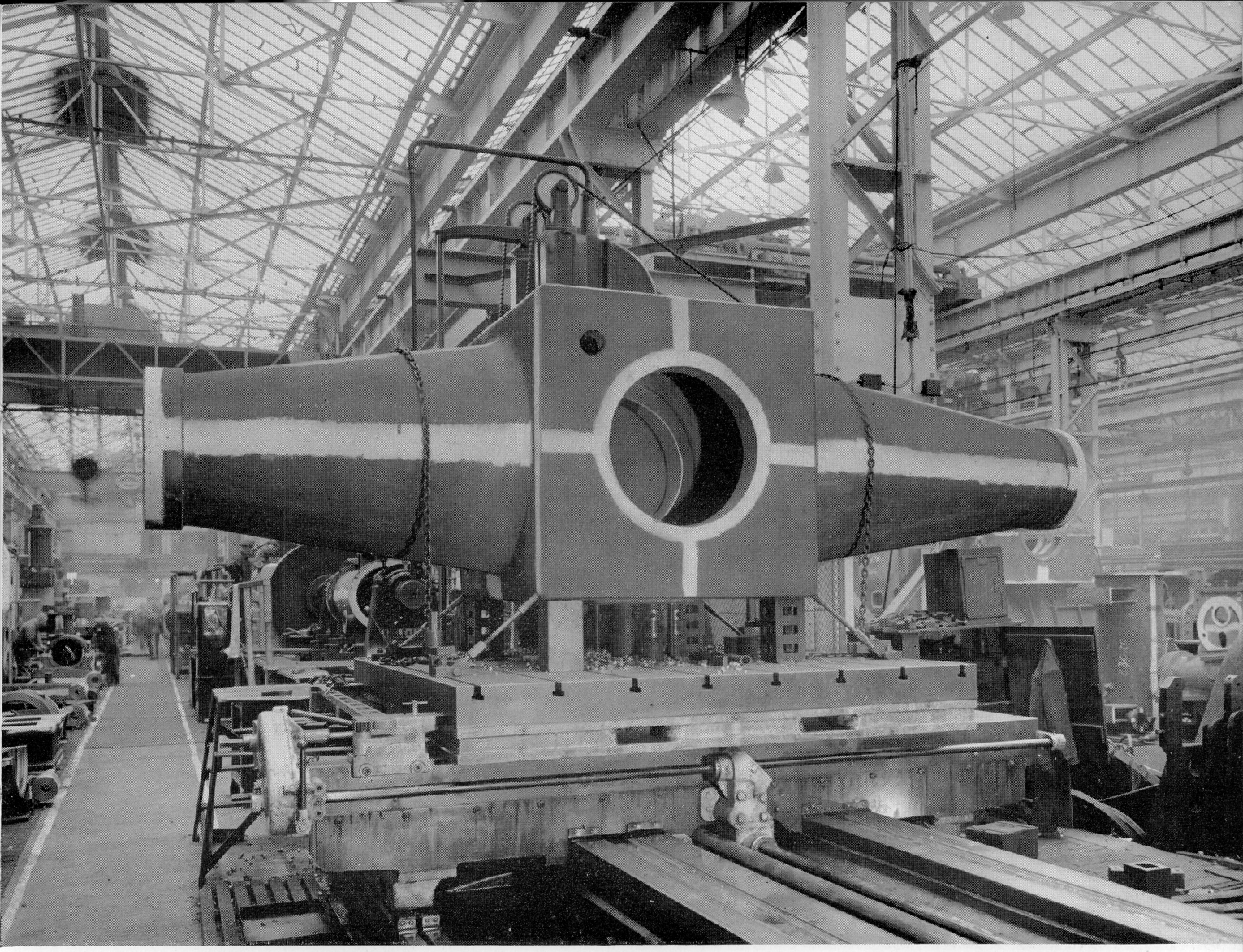
**PRIME FOCUS**

The plateholder and focussing gear fitted on the 36-inch Reflector built for the Cambridge University Observatory. The plateholder is designed for plates $3\frac{1}{4}$ inches square and guiding motions in two coordinates are provided. Knife edging and guiding are done by observation at the edge of the tube; the guiding telescope alignment rod is removed for observation.



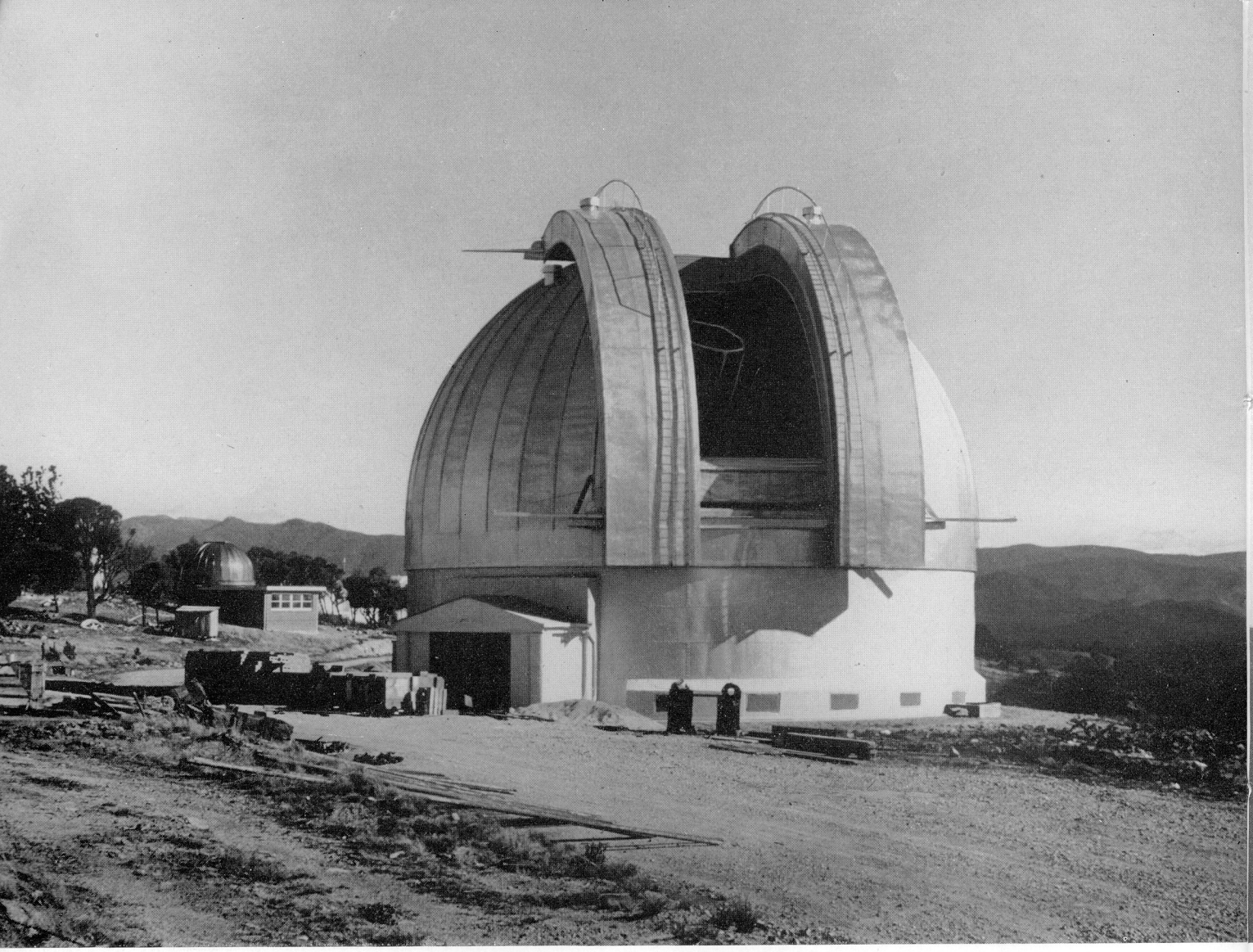
## FITTING SHOPS

The manufacture of a big telescope involves fitting work on large parts, weighing several tons as well as fine mechanical adjustment on the small micrometers and eyepieces. The photograph shows the assembly of the declination axis for a 74-inch Reflector.



## MACHINE SHOPS

The photograph shows a machining operation on the 12 ton polar axis of a 74-inch telescope. Modern heavy machine tools in the works of the parent company C. A. Parsons & Co. Ltd., the world-famous manufacturers of turbo-generating plant, are available for the machining of such heavy parts of telescopes.



**60 FT. DOME**

The single storey building, and the rotating Dome for the 74-inch Reflector at Mt. Stromlo were designed and built by Grubb Parsons. Both are constructed from steel framing and clad with a sheet steel skin. There is a hollow air space between the inner and outer walls for air circulation from ground level to the top of the Dome, controlled by a system of adjustable louvres.



## OTHER PRODUCTS

In addition to astronomical telescopes the Company manufactures a number of specialised infra red instruments. The photograph shows a Grubb Parsons double beam grating infra red spectrometer for the 2-15 micron region. The spectrometer is conveniently mounted upon a Console which houses the electronic equipment, and the radiation unit embodies a strip chart recorder also designed and manufactured by the Company.



## LABORATORIES

Adjacent to the erecting shops are modern laboratories well equipped for the study of the many mechanical, electrical and physical problems encountered during manufacturing processes. These laboratories are of most modern design with double windows and combined heating and lighting troughs in the ceilings affording the best working conditions.




## A GENERAL VIEW OF THE WORKS

The photograph shows the large erecting bay recently completed for assembling telescopes. The bay is equipped with a 40 ton crane and full engineering facilities. To the left of this building can be seen the new air conditioned offices and research laboratories.

## A LIST OF THE LARGE TELESCOPES MANUFACTURED BY SIR HOWARD GRUBB PARSONS & CO. LTD.

| | | |
|---|---|---|
| 18 inch | Coelostat and 12 inch Objective for the Solar Telescope at the Canberra Observatory, Australia | 1927 |
| 36 inch | Cassegrain Reflecting Telescope for the Royal Observatory, Edinburgh, Scotland | 1930 |
| 24 inch | and 20 inch Twin Refractor at the Saltzjobaden Observatory of the Royal Academy of Science, Stockholm, Sweden | 1931 |
| 40 inch | Reflecting Telescope in the Saltzjobaden Observatory of the Royal Academy of Science, Stockholm, Sweden | 1931 |
| 18 inch | Reflector for the Mills Observatory, Dundee, Scotland | 1933 |
| 36 inch | Cassegrain Reflecting Telescope for the Royal Observatory, Greenwich | 1933 |
| 16 inch | Solar Telescope for the University Observatory, Oxford | 1934 |
| 74 inch | Reflecting Telescope for the David Dunlap Memorial Observatory of Toronto University, Canada | 1935 |
| 16 inch | Photographic Refractor with 8 inch guider for the Johannesburg Observatory of the Leiden University, South Africa | 1938 |
| 74 inch | Reflecting Telescope for the Radcliffe Observatory, Pretoria, South Africa | 1938 |
| 13 inch | and 10 inch Twin Refractor at the Marshal Pilsudski Memorial Observatory, Rozspiewany, Poland | 1938 |
| 10 inch | Horizontal Coelostat for the Arosa Observatory, Switzerland | 1949 |
| 20 inch | Reflecting Solar Telescope for the University Observatory, Oxford | 1953 |
| 7 inch | Reversible Transit Circle for the San Fernando Observatory, Spain | 1953 |
| 17-24 inch | Schmidt Telescope for the University Observatory, Cambridge | 1954 |
| 10 inch | P.Z.T. for the Neuchatel Observatory, Switzerland | 1954 |
| 7 inch | Reversible Transit Circle for the Royal Observatory, Copenhagen, Denmark | 1954 |
| 74 inch | Reflecting Telescope for the Mt. Stromlo Observatory, Australia | 1955 |
| 36 inch | Reflecting Telescope for the University Observatory, Cambridge | 1955 |
| 10 inch | P.Z.T. for the Royal Greenwich Observatory, Herstmonceux | 1955 |
| 74 inch | Reflecting Telescope for the Helwan Observatory, Egypt | 1956 |
| 75 inch | Reflecting Telescope for the St. Michel Observatory, France | 1956 |
| 10 inch | P.Z.T. for the Mt. Stromlo Observatory, Australia | 1956 |

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